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(54) **Sifter frame for powder particle sifter**

Siebkasten für Pulverteilchensieb

Châssis pour cribleur de particules de poudre

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Description

Background of the Invention

Field of the Invention

[0001] The present invention relates to a sifter frame according to the preamble of claim 1 used as a sifter for separating the particle sizes of powder particles such as flour and the like, and more specifically, but not exclusively, to a structure of an intimate contact type sifter frame used by being stacked into multi-stages to sift and separate powder particles.

Description of the Related Art

[0002] Sifters are conventionally used to separate the particle sizes of powder particles such as flour and the like. The sifter will be described below with respect to the separation of the particle sizes of flour by way of example.

[0003] Sifter types known as plan sifter, square sifter and the like are used in the flour milling industry from old times to separate the particle sizes of flour, and at present various types of sifters such as the modifications of the above sifters and intermediate type sifters (such as a junior type sifter and the like) are put into practical use. These sifters are fundamentally arranged such that powder having a small particle size in powder supplied onto the sifter is caused to pass through the sifter downwardly while a multiplicity of stacked sifter frames are caused to make a circular motion to separate the particle sizes of the supplied powder. A reason why the flour sifter is composed of the sifter frames stacked to the multi-stages as described above is to make the sifter area as large as possible, which is desirable to effectively separate flour by moving the flour on the surface of the sifter. To achieve this object,the area of the sifter per unit area of installation is increased to save the installation area in such a manner that the sifter is composed to sifter frames stacked to the multi-stages and a sifter surface on which flour moves is formed so that the sifter surface vertically meanders in the sifter.

[0004] The sifter is usually composed of a group of stacked square sifter frames tightened from the upper and lower sides thereof or a group of sifter frames which are stacked to ten to twenty stages and accommodated in a sifter frame box called a box so that they are horizontally tightened and fixed and also tightened and fixed from the upper side thereof. Then, the box and the like are driven by a drive unit composed of an eccentric shaft provided with a balance weight and a drive shaft to make a circular motion within a horizontal plane at high speed.

[0005] Since sifter nets used to the sifter frames constituting the sifter are required to be checked and replaced at predetermined intervals, several hundreds to several thousands of the sifter nets must be always stored to cope with the requirement in industrial equipment. To facilitate replacement, conventionally employed is a sifter frame which has a structure for limiting a portion to be replaced only to a sifter net. That is, there are generally used a pair of a frame member of about 1 m x 1 m (referred to as an outer frame) and a frame member having a sifter net stretched therein as an object to be replaced (referred to as an inner frame) with the inner frame being engaged with the outer frame. With the employment of this arrangement, even if several thousands of the sifter frames are required to be prepared and stored, since the outer frames can be repeatedly used, it suffices only to actually prepare the inner frames, which is preferable from the view point of industrial facility because the volume and weight of the inner frames to be stored are reduced and a replacing job can be eased and labor can be saved accordingly.

[0006] A structure of the conventionally used sifter frame will further be described in more detail with reference to FIG. 6 - FIG. 10 of the accompanying drawings.

[0007] The conventional type sifter frame shown in these figures has a combination type structure arranged such that a rectangular inner frame 500 (refer to FIG. 6) is fitted with in the inner frame fitting portion of an outer frame 600 (refer to FIG. 7), the inner frame 500 having a sifter net 501 stretched over the upper surface thereof to separate flour to powder on a sifter (rough powder) and powder below the sifter (through: fine powder), and the outer frame 600 being in contact with the three circumferential sides of the inner frame and having a longitudinal path in an upward/downward direction (refer to FIG. 8).

[0008] The above inner frame 500 shown in FIG. 6 is composed of wood frame member 502 - 505 of, for example, wood for constituting a rectangular four-side frame and a sifter net 501 having a predetermined sifting mesh and stretched over reinforcing wood bars 506, 507 formed to a cross shape and disposed inwardly of the rectangular frame member. Note, although not shown, a crimp net having a rough mesh is usually stretched below the sifter net 501 in parallel therewith and a cleaner such as, for example, a triangular flat cleaner having a hemispheric projection is movably interposed between the upper and lower nets so that clogging of the sifter net 501 is prevented by causing the cleaner to beat the net when the sifter is in operation.

[0009] The outer frame 600 shown in FIG. 7 is composed of an inner frame fitting portion within which the above inner frame 500 is fitted in contact with or biased to an outer side wall outer block member 610 as one of the four sides of the rectangular frame forming the outer block of the outer frame 600 and longitudinal paths 601, 602, 602 disposed outwardly of the inner frame fitting portion in an upward/downward direction along the inside of each of the remaining three sides except the side wall 610 of the above one side. Specifically, the outer frame 600 is composed of a pair of parallel inner side walls (frame members) 607, 607 disposed to form the above inner frame fitting portion, three inner frame fitting

stand frames 604, 605, 606 fixed over the lower surfaces of the inner side walls 607, 607. A pair of outer side walls 608, 608 is disposed separately to form the fine powder dropping ports 602, 602 to the outside of each of the above outer inside walls 607, 607, and the outer side wall 610 is disposed in contact with the outside of the inner frame fitting stand frame 606, An outer side wall 609 is separately disposed to form a rough powder dropping port 601 (usually, called an over port) outwardly of the inner frame fitting stand frame 604, and a receiving plate (fine powder flowing plate) 603 is provided as a bottom surface for introducing fine powder (through) having passed through the sifter net 501 of the inner frame to be fitted to the above right and left dropping ports 602, 602. The inner side walls 607, 607 are fixed to the outer side walls 608, 608 at suitable positions through intermediate brackets 613, 613, and the inner frame fitting stand frame 604 is fixed to the outer side wall 609 through an intermediate bracket 615 in the same way. Numeral 614 denotes blocks disposed at four corners to close the unnecessary space portions in the outer frame as well as to increase the strength of a fitting structure in an upward/downward direction.

[0010] The receiving plate 603 is composed of a stainless steel sheet or the like fixed to the respective lower surfaces of the above inner frame fitting stand frames 604, 605, 606 by screws. With this arrangement, each of the right and left ends of the receiving plate 603 has a gap corresponding to the thickness of the stand frames 604, 605 between the lower surface of the inner side wall 607 and the receiving plate 603, and these gaps form slit-shaped fine powder dropping ports 617 for dropping fine powder dropped onto the receiving plate 603 into the right and left fine powder dropping ports 602. Note, the receiving plate 603 is disposed substantially at the intermediate position in the upward-downward direction of the sifter frame in a bottom-lifted-state (refer to FIG. 9). With this arrangement, a space in which powder moves on the sifter net 501 of a lower stage sifter frame is provided when sifter frames are stacked. Note, when a direction is described below, a direction in which a pair of the fine powder dropping ports 602 is separated from each other is referred to as a right/left direction and a direction orthogonal to the right/left direction in a horizontal direction is referred to as a forward/backward direction.

[0011] A group of the sifter frames having the above arrangement can be constructed by stacking a multiplicity of the sifter frames in such a manner that the positions of the rough powder dropping ports 601 are successively reversed (alternately disposed) on the respective stages (refer to FIG. 9). Then, powder particles having moved (flown) on the sifter net 501 of a certain stage drop into the rough powder dropping port 501 of the inner frame 500 along the inclined surface 502a of the frame member 502 in contact with the rough powder dropping port 601 and moves onto the sifter net of the sifter frame of the next lower stage. Further, fine powder having passed through the sifter net 501 drops onto the receiving plate 603 and further drops into the fine powder dropping ports 602 through the right and left slit-shaped fine powder dropping port 617.

[0012] Note, press beams 620, 620 are disposed between the outer side walls 609, 610 below the receiving plate 603 of the outer frame 600 so that the press beams 620, 620 extend to the upper surfaces of the inner side wall 607 and the frame member 504 (or 505) of the inner frame of the lower stage sifter frame to cover them in contact therewith (refer to FIG. 9).

[0013] Incidentally, the sifter is naturally required to securely prevent the mixture of rough powder with fine powder caused through the gap defined at the inner frame fitting position. For this purpose, the lower portion of the frame member 502 of the inner frame 500 is provided with a stepped portion as shown in FIG. 8 (b) and the stepped leg portion 502b is engaged with the stepped portion 604a of the inner frame fitting stand frame 604 formed in correspondence with the outer frame to form seal portions.

[0014] FIG. 8 (a) is an unfolded view for explaining the relationship between the outer frame 600 and the inner frame 500 fitted therewith, and FIG. 9 is an unfolded view for explaining a state that the sifter frames each arranged as described above are stacked with the rough powder dropping ports 601 thereof successively disposed alternately. Note, in FIG. 9, surfaces 700, 701 shown cross-hatched serve as seal surfaces for strongly pressing the inner frame 500 of the lower stage sifter frame downwardly by the upper stage sifter frame (outer frame 600) so as to increase the seal pressure of the above seal portions and at the same time to seal and partition a region (rough powder region) where rough powder flows from a region where fine powder flows (fine powder region). A suitable seal sheet is applied to the surfaces 700, 701 as necessary.

[0015] In the aforesaid conventional sifter, although a group of the sifter frames is composed of a multiplicity of the stacked sifter frames each arranged as described above to sift and separate flour, it is known that actually a slight amount of rough powder is mixed with fine powder.

[0016] Since the mixture of rough powder and the like caused by the conventional sifter is not ignored in a strict meaning regardless of a recent tendency that a powder product which has an increased added value or with which any of rough powder and the like is not mixed at all is required, however, the sifter is desired to be further improved.

[0017] The inventors have found the following fact by examining a cause of the mixture of rough powder with fine powder, taking the present state mentioned above into consideration. That is, there is a problem that although the mixture of rough powder with fine powder in the conventional sifter frame is not caused on the above seal surfaces 700, 701 which are in intimate contact with each other under pressure, the mixture of them is

caused at the portion where the frame member 502 is fitted with the inner frame fitting stand frame 604.

[0018] This will be described as follows with reference to FIG. 10. More specifically, first, although the portion, where the frame member 502 of the inner frame in contact with the rough powder dropping port 601 is fitted with the inner frame fitting stand frame 604 of the outer frame, is sealed by the engagement of the stepped portion 502b with the stepped portion 604a shown in FIG. 8 (b), no pressure is directly applied to the portion from the upper and lower frames to make the intimate contact therebetween. Thus, a problem arises in that they are not sufficiently sealed. Further, the following matter becomes apparent as a larger problem. That is, although brackets 616 provided to form the inner frame fitting portion of the outer frame are engaged with the extreme (front) end surfaces (surfaces facing to the rough powder dropping port) 504a, 505a of the right and left frame members 504, 505 of the inner frame to seal a fine powder region and a rough powder region, no pressure is applied to make the intimate contact of the both surfaces of the fitting portion in the structure. More specifically, the direction of a horizontal force for causing the both surfaces to come into intimate contact with each other is different 90° from a vertical force for causing the upper and lower sifter frames to come into intimate contact with each other. On the other hand, a gap is inevitably produced between the surfaces due to a dimensional allowance in production and a dimensional variation caused by the elapse of time as an actual problem. Consequently, it is difficult to completely prevent the phenomenon that rough powder flowing on the sifter net as shown by a thick slid line 800 in FIG. 10 moves at random in the sifter frame which is violently vibrated when the powder is separated by the sifter and enters a gap between the above extreme end surface 505a and the bracket 616 as shown by a thick dotted line 801 in the Figure. Further, since it is also inevitable that a gap is produced between the outside surface of the frame member 505 (504) of the inner frame and the inside surface of the inner side wall 607 of the outer frame, the rough powder having entered the above gap further moves and enters the fine powder region as shown by dotted lines 802, 803, by which the aforesaid mixture is caused.

[0019] Further, since the frame member 502 in contact with the rough powder dropping port of the inner frame is not directly pressed in an upward/downward direction by the outer frame of the upper/stage sifter frame being stacked, a force for causing the both surfaces of the frame member 502 and the above member (inner frame fitting stand frame 604) to come into intimate contact with each other is weakened in the vicinity thereof. As a result, since it is inevitable that a gap is produced between the frame member 502 and the stand frame 604 by the vibration of the sifter frame, rough powder also enters the fine powder region at this portion.

[0020] The problem that rough powder enters the fine powder region though the gaps between the confronting surfaces to which the above intimate contact force is not applied can be of course solved by consisting a sifter frame of an inner frame and an outer frame which are integrally arranged each other so that the sifter frame is not divided into the inner frame and the outer frame. With this arrangement, however, there cannot be satisfied the aforesaid requirement from the view point of the industrial equipment for limiting the portion to be replaced of each of the sifter frames amounting to several thousands to an area as small as possible in order to that storing volume is reduced and labor for a replacement job is saved.

[0021] Further, there is a possibility that the influence resulting from vibration can be prevented so as to avoid the aforesaid unacceptable matters by the employment of a method of fixing the inner frame to the outer frame by means of tightening means such as bolts or the like, When such a method is employed, the attachment and detachment of the inner frame to and from the outer frame is very time consuming, by which the device of partially replacing the sifter frame is made quite useless.

[0022] Preferred embodiments of the present invention provide a novel powder separating sifter frame, alleviating the above various problems, and capable of reducing the storing volume by limiting the portion of the sifter frame to be prepared and stored, as well as satisfying a requirement for saving labor needed by a replacement job, and securely preventing the mixing of rough powder with fine powder, which has been sometimes caused by a conventional sifter frame.

[0023] According to one aspect of this invention there is provided a sifter stage for being stacked with other similar stages to provide a multi-stage sifter for separating particulate material into sifted (fine) and non-sifted (rough) fractions, said sifter stage comprising:-

an outer frame,
an inner frame fitted within said outer frame,
said inner frame comprising a generally rectangular frame element for supporting a perforate sieve surface,
said outer frame including a collection surface for collecting sifted powder passing through said sieve surface and discharging said collected powder into at least one fine powder dropping port extending generally vertically, and means defining a generally vertically extending rough powder dropping port into which in use non-sifted powder is caused to pass on leaving said sieve surface,

characterised in that said outer frame includes wall means defining a rectangular recess for receiving said inner frame, and the upper surfaces of said wall means, and the upper peripheral surface of said inner rectangular frame elements together define an upwardly facing closed rectangular generally co-planar seal surface means, and selected lower surface regions of said

outer frame define a corresponding downwardly facing, closed rectangular generally co-planar seal surface means, whereby when stacked in use with a similar stage with the rough powder dropping posts alternately disposed, the downwardly facing seal surface means is in sealing engagement with the upwardly facing seal surface means, and further in that said inner frame includes a downwardly facing, closed rectangular seal surface means which surrounds said rough powder dropping port and said outer frame includes an upwardly facing, closed rectangular seal surface means for sealingly co-operating with said downwardly facing seal surface means.

[0024] In the above arrangement, it is most preferable to form the lower surface of the sifter frame stacked to the upper stage in such a manner that the lower surface extends to and air-tightly engages with both upper surfaces of the outer frame and the inner frame which are formed by being fitted with the sifter frame stacked to the lower stage.

[0025] Further, in the above arrangement, it is preferable similarly to the above to apply a sheet suitable for intimate contact seal along any one of the lower closed annular edge of the inner frame fitting portion of the outer frame or the lower closed annular edge of the outer frame fitting portion of the inner frame.

[0026] In preferred embodiments of the present invention, since a portion to be replaced is limited to the inner frame having the sifter net portion and the portion of the rough powder dropping port similarly to the above, the weight and size of the inner frame can be reduced as compared with those of an inner frame arranged integrally as a whole. Further, since the seal surfaces for partitioning and sealing the rough powder region from the fine powder region are formed as the closed type rectangularly annular edges located on the same plane and an upward/downward intimate contact force acts on the seal surfaces, a strictly partitioned seal can be achieved which need not take the leakage between the rough powder region and the fine powder region into consideration.

[0027] Further, since the partitioning structure for partitioning the rough powder region from the fine powder region can be arranged by the frame members of the inner frame or the outer frame itself and these regions can be sealed only by the intimate contact of the horizontal seal surfaces which are engaged in an upward/downward direction, the above partitioning structure does not have the seal structure of prior art which contains a vertically sealed surface as shown in FIG 6 - FIG 10. Consequently, there can be obtained a good partitioned seal by which a possibility that rough powder is mixed with fine powder is securely prevented.

[0028] Further, a better seal state can be secured by the application of an intimate contact sheet to each seal surface.

[0029] The invention may be performed in various ways, and various embodiments thereof will now be described by way of example only, reference being made to the accompanying drawings in which:-

FIG. 1 is an outside perspective view of an inner frame constituting a sifter frame of an embodiment of the present invention;
FIG. 2 is an outside perspective view of an outer frame constituting the sifter frame of Fig.1;
FIG. 3 is an exploded view showing how the inner frame is fitted within the outer frame thereof;
FIG. 4 is an outside perspective view showing how the inner frame and the outer frame shown in the unfolded view of FIG. 3 are fitted with each other for assembly;
FIG. 5 is an exploded view explaining a relationship of engagement when sifter frames of FIG. 4 each obtained by fitting the inner frame with the outer frame thereof,are stacked in an upward/downward direction;
FIG. 6 is an outside perspective view showing an arrangement of an inner frame constituting a sifter frame of prior art;
FIG. 7 is an outside perspective view showing an arrangement of an outer frame constituting the sifter frame of the prior art;
FIG. 8 (a) is an exploded view showing an inner frame and an outer frame constituting the sifter frame of the prior art are fitted with each other for assembly and FIG. 8 (b) is a longitudinal cross sectional view showing engagement of the frame member 502 of the inner frame within the partition wall 604 of the outer frame
FIG. 9 is a view showing the relationship of engagement when the assembled sifter frames of the prior art are stacked in an upward/downward direction; and
FIG. 10 is a view perspectively showing the interior of the main portion of the sifter frame of the prior art to show how a mixture of rough powder (powder particles to be treated),with fine powder.

[0030] In FIG. 1 - FIG. 5, numeral 405 denotes an inner frame which is composed of, for example, square column wood frame members 452 - 455 constituting a rectangular four-sided frame, a partition wall 458 for partitioning the inside of the rectangular four-side frame into a sifter net region 450 and a region for a rough powder dropping port 459. Reinforcing wood bars 456, 457 are disposed in the sifter net region 450 in a cross shape, and a sifter net 451 stretched over the upper surface of the sifter net region 450. Note, a crimp net is stretched in the vicinity of the lower side of the sifter net 451 in parallel therewith and a cleaner (neither shown) is movably interposed between the nets to prevent the clogging of the net in a manner similar to the prior art arrangements of Fig. 6 to 10.

[0031] As apparent from FIG. 1 and FIG. 3, the inner frame 405 of the embodiment has a feature that since

each of the frame members 452 - 455 and the partition wall 458 is composed of a square column member having the same height, the upper and lower surfaces of these frame members and the partition wall form rectangularly annular surfaces and the like which are flush with each other. Another feature of the inner frame 405 of the embodiment is that the three frame members 454, 455, 458 constituting a rough powder dropping port 459 provided in the inner frame 405 have upper and lower surfaces which can make an air-tight seal with a horizontal surface. Thus a rough powder dropping port 469, which is provided within the outer frame into which the inner frame 405 is to be inserted and fitted, is air-tightly partitioned.

[0032] For the above purpose, the upper surfaces and lower surfaces of the inner frame of the embodiment are made flush with each other; that is, this arrangement is made so that when sifter frames are stacked to multistages, surfaces to be sealed are formed on the same plane. That is, to explain with respect to the above embodiment, in order to seal the engaging surfaces denoted by numeral 458a around the rough powder dropping port 459, it is preferable to apply an intimate contact sheet such as non-woven fabric, felt or the like to the lower surface of the four sides thereof (or to the upper surface of the four sides of the outer frame) (refer to FIG. 3). An inclined surface similar to that of the prior art arrangements of Fig. 6 to 10 may be formed on the partition wall 458 (refer to numeral 502a of FIG. 6) to enable rough powder to easily drop into the rough powder dropping port 459.

[0033] FIG. 2 shows the outer frame 406 of the embodiment. An inner frame fitting portion 460 formed as a recessed rectangular shape by a pair of inner side walls 461, 461 and a pair of outer side walls 462, 463 perpendicular to them. The inner frame 405 which is inserted into and fitted within the outer frame is also formed to a rectangular shape. The inside of the outer frame 406 is partitioned to a fine powder receiving region provided with a receiving plate 467 and the rough powder dropping port 469 by a partition wall 468. The rough powder dropping port 469 and the partition wall 468 are arranged such that the position and shape thereof coincide with those of the rough powder dropping port 459 and the partition wall 458 of the inner frame 405.

[0034] A pair of outer side walls 464, 464 are disposed outwardly of a pair of the inner side walls 462, 462 in parallel therewith and fixed to the outer side walls 462, 463 and the inner side walls 461, 461 by blocks 471, 471, 471, 471 at four corners and reinforoing intermediate brackets 472, 472 to form a rectangular four-sided frame as a whole. Fine powder dropping ports 465, 465, each open in a generally vertical direction are defined between a pair of the inner side walls 461, 461 and a pair of the outer side walls 464, 464. Note, numeral 466 denotes a reinforcing intermediate bracket for fixing the partition wall 468 to the outer side wall 462.

[0035] The receiving plate 467 in the embodiment is composed of a rectangular stainless steel sheet fixed by screws to the lower surfaces of, for example, the partition wall 468 and inner frame receiving stands 473, 474 disposed between a pair of the inner side walls 461 of the lower surfaces thereof. The inner frame receiving stands 473, 474 are composed of two wood bars each having the same height as that of the partition wall 468. Further, lower inner side walls 476, 476 are disposed on the lower side of the receiving plate 467 so that they constitute a pair with the inner side walls 461, 461. The lower surfaces of the lower inner side walls 476, 476 are flush with the lower surfaces of the outer side walls 462 - 464. Note, the inner frame receiving stand 474 is disposed in contact with the outer side wall 463 and another inner frame receiving stand 473 is disposed at an intermediate position between the partition wall 468 and the inner frame receiving stand 474. Since they are disposed as described above, the receiving plate 467 provides a space for the fine powder receiving region for receiving fine powder (through) having passed through the sifter net 451 of the inner frame 405 inserted into and fitted within the inner frame fitting portion. As the shifter frame is vibrated, the fine powder is dropped into the fine powder dropping ports 465 from slit-shaped fine powder dropping ports 475 each formed between the lower surface of the inner side wall 461 and the receiving plate 467. Note, numeral 477 denotes brackets fixed to close gaps between the inner side wall 461 and the lower inner side wall 476 at the both ends of the rough powder dropping port 469.

[0036] The upper surface of the partition wall 468 and the upper surfaces of the inner frame receiving stands 473, 474 in the inner frame fitting portion are located at such a depth that,when the inner frame 405 is placed on the above surfaces by being inserted into and fitted within the inner frame fitting portion, the upper surfaces of the inner side wall 461 and the outer side walls 462 - 464 are flush with the upper surface of the inner frame 405.

[0037] Note, as described with reference to FIG. 5, the lower inner side wall 476 has a thickness for enabling the lower surface 476a thereof to be extended across the upper surfaces of the inner side wall 461 and the frame member 454 (or 455) of the inner frame of a sifter frame stacked to the lower stage. With this provision, when sifter frames are stacked, an intimate contact force can be applied to the inner frame 405 in a generally vertical direction and further a gap between the inner side wall 461 and the frame member 454 (or 455) through which rough powder may enter the fine powder region can be securely sealed by the lower inner side wall 476 extending thereacross. Further, it is preferable that the lower portions of the outer side walls 462, 463 are made thicker than the upper portions thereof by being provided with a taper or being stepped, and the outer side wall 462 is composed of a frame member which is thicker than the outer side wall 463, and an additional

depressing bracket is used so that the frame members 452, 453 of the inner frame 405 of a sifter frame stacked to the lower stage are depressed by the outer side walls 462, 463 of the outer frame 406 of the upper stage.

[0038] FIG. 3 shows how the inner frame 405 arranged as described above is inserted into and fitted within the inner frame fitting portion 460 of the outer frame 406 arranged as described above. That is, the inner frame 405 is inserted into and placed on the partition wall 468 and the inner frame receiving stands 473, 474 in the inner frame fitting portion 460 formed by the receiving plate 467, the inner side walls 461, 461, the outer side walls 462, 463 and the like of the outer frame 406. FIG. 4 shows the inside frame 5 assembled within the outer frame 6.

[0039] In this way, as shown in FIG. 4, a sifter frame is assembled such that the region of the rough powder dropping port 469 is partitioned from the fine powder region (formed as the space between the sifter net 451 and the receiving plate 467) by the partition walls 458, 468 of the inner frame and the outer frame and the other three sides. The fine powder dropping ports 465, 465 on both sides are caused to communicate with the rough powder region through the slit-shaped fine powder dropping ports 475,but are partitioned from the rough powder dropping port 469 by the inner side wall 461, the lower inner side wall 476 and the brackets 477.

[0040] Then, as shown in FIG. 5, a plurality of the sifter frames each assembled as described above are stacked with the rough powder dropping ports 469 thereof successively disposed alternately to arrange a group of the sifter frames. An annular seal surface 480 (shown by cross-hatching in the Figure) formed by applying the intimate contact sheet on the lower surface of the sifter frame of the upper stage in FIG. 5 comes into contact with a closed annular seal surface 481 formed on the upper surface of the sifter frame of the lower stage (shown by cross-hatching in the figure), so that these seal surfaces are caused to firmly come into contact with each other by biass pressure from the upper and lower side of the group of the sifter frames. With this arrangement, the rough powder dropping ports 469 of the rough powder regions, which are partitioned from the other spaces by a plurality of the stacked sifter frames and directed generally vertically, are located at the alternate positions of the respective stages, Also, the space formed below the sifter net 451 and the receiving plate 467 of the upper stage sifter frame is partitioned and sealed from the fine powder dropping ports 465, 465 by the lower inner side wells 476, 476, whereby the continuous rough powder region which meanders horizontally from the upper side toward the lower side as a whole is formed. On the other hand, the fine powder dropping ports 465, 465 are formed as a port which is continued in a generally vertical direction by the stacked sifter frames and communicates with the space below the sifter net of the sifter frame of each stage through the slit-shaped fine powder dropping ports 475 as described above.

[0041] When a group of the sifter frames each arranged as described above are stacked to multi-stages and rough powder is supplied onto the sifter net of the uppermost sifter frame while the sifter frames are caused to make a circular motion, the rough powder drops onto the sifter net 451 of the next stage from the rough powder dropping port 469 while moving on the sifter net 451, then moves on the sifter net 451 of the next stage to the rough powder dropping port 469 located on the opposite side in the same way and further drops onto the sifter net of the next stage. Then, the rough powder is discharged to the outside of the system through the lowermost sifter frame while meandering with the successive repetition of the above operation. On the other hand, fine powder having passed through the sifter nets 451 of the respective stages drops onto a receiving plate 467, then drops into the fine powder dropping ports 465, 465 from right and left slit-shaped fine powder dropping ports 475 and is introduced to a fine powder collection path.

[0042] According to the sifter using the sifter frames arranged as described above, since the seal surfaces for partitioning and sealing the rough powder region from the fine powder region are formed as the annular seal surfaces located on the same plane, portions on which a pressure applying force does not act, which is found in prior art, do not exist anywhere, so that an intimate contact seal can be securely realized and a possibility of the mixture of rough powder with fine powder in the fine powder region can be securely prevented.

[0043] When a test for sifting and separating flour was effected using the sifter having the arrangement of the invention described with reference to FIG. 1 - FIG. 5, it has been confirmed that the mixture of rough particles with fine powder can be completely prevented.

Claims

1. A sifter stage for being stacked with other similar stages to provide a multi-stage sifter for separating particulate material into sifted fine and non-sifted rough fractions, said sifter stage comprising:-

   an outer frame (406),
   an inner frame (405) fitted within said outer frame (406),
   said inner frame (405) comprising a generally rectangular frame element (452-455) for supporting a perforate sieve surface (451),
   said outer frame (406) including a collection surface (467) for collecting sifted powder passing through said sieve surface (451) and discharging said collected powder into at least one fine powder dropping port (465) extending generally vertically, and means (461, 462, 468) defining a generally vertically extending rough

powder dropping port (469) into which in use non-sifted powder is caused to pass on leaving said sieve surface (451),

characterised in that said outer frame (406) includes wall means (461--463) defining a rectangular recess for receiving said inner frame, and the upper surfaces of said wall means (461--463), and the upper peripheral surface of said inner rectangular frame element (452-455) together define an upwardly facing closed rectangular generally co-planar seal surface means (481), and selected lower surface regions of said outer frame (406) define a corresponding downwardly facing, closed rectangular generally co-planar seal surface means (480), whereby when stacked in use with a similar stage with the rough powder dropping posts alternately disposed, the downwardly facing seal surface means (480) is in sealing engagement with the upwardly facing seal surface means (481), and further **in that** said inner frame (405) includes a downwardly facing, closed rectangular seal surface means (458a) which surrounds said rough powder dropping port (459) and said outer frame (406) includes an upwardly facing, closed rectangular seal surface means (468) for sealingly co-operating with said downwardly facing seal surface means (458a).

2. A sifter frame for a powder particle sifter, according to Claim 1, wherein an intimate contact seal sheet is applied to at least one of said seal surfaces (480,481).

Patentansprüche

1. Siebeinrichtung, die mit anderen ähnlichen Einrichtungen übereinander angeordnet ist, um ein mehrstufiges Sieb bereitzustellen, das Teilchenmaterial in gesiebte feine und nicht gesiebte grobe Teile trennt, wobei die Siebeinrichtung aufweist:

einen äußeren Rahmen (406),
einen inneren Rahmen (405), der in diesen äußeren Rahmen (406) eingepasst ist,
wobei der innere Rahmen (405) ein im wesentlichen rechtwinkeliges Rahmenelement (452-455) zur Unterstützung einer löchrigen Siebfläche (451) aufweist,
wobei der äußere Rahmen (406) eine Sammelfläche (467) hat, um gesiebtes Pulver anzusammeln, welches durch die Siebfläche (451) dringt und das angesammelte Pulver in zumindest einen feines Pulver einlassenden Auffangbereich (465) führt, der sich im wesentlichen vertikal erstreckt, und eine Einrichtung (461, 462, 468), die einen sich im wesentlichen vertikal erstreckenden Auffangbereich (469) für grobes Pulver bildet, in welchem bei Betrieb das nicht gesiebte Pulver so weitergeführt wird, dass es die Siebfläche (451) verlässt,

dadurch gekennzeichnet, dass der äußere Rahmen (406) eine Wandeinrichtung (461-463) aufweist, die eine rechtwinklige Aussparung bildet um den inneren Rahmen zu halten, wobei die höher gelegenen Flächen der Wandeinrichtung (461-463) zusammen mit der höher gelegenen, äußeren Fläche der inneren rechtwinkligen Rahmenelemente (452-455) eine nach oben gerichtete, abgeschlossene, rechtwinklige, im wesentlichen koplanare Dichtflächeneinrichtung (481) bilden und ausgesuchte niedrig gelegene Flächenbereiche des äußeren Rahmens (406) eine entsprechend nach unten gerichtete, abgeschlossene, rechtwinkelige, im wesentlichen koplanare Dichtflächeneinrichtung (480) bilden, wobei wenn es mit einer ähnlichen Einrichtung übereinander angeordnet in Betrieb ist, mit dem grobes Pulver ausgebenden, alternierend angeordneten Elementen so angeordnet sind, dass die nach unten gerichtete Dichtflächeneinrichtung (480) eine dichte Verbindung mit der nach oben gerichteten Dichtflächeneinrichtung (481) eingeht und des weiteren in dem inneren Rahmen (405) eine nach unten gerichtete, abgeschlossene, rechtwinkelige Dichtflächeneinrichtung (458a) aufweist, welche den grobes Pulver einlassenden Auffangbereich (459) umgibt, und der äußere Rahmen (406) eine nach oben gerichtete, abgeschlossene, rechtwinkelige Dichtflächeneinrichtung (468) aufweist, um zusammen mit der nach unten gerichteten, abgeschlossenen, rechtwinkeligen Dichtflächeneinrichtung (458a) dichtend zusammenzuwirken.

2. Siebkasten für einen Pulverteilchensieb nach Anspruch 1, wobei eine Dichtkontakt-Dichtungsschicht zumindest auf eine der Dichtflächeneinrichtung (480, 481) aufgebracht ist.

Revendications

1. Etage de cribleuse destiné à être empilé avec d'autres étages similaires afin de fournir une cribleuse à étages multiples pour séparer une matière particulaire en fractions fines criblées et grossières non criblées, ledit étage de cribleuse comprenant :

- un châssis extérieur (406) ;
- un châssis intérieur (405) monté à l'intérieur dudit châssis extérieur (406),
- ledit châssis intérieur (405) comprenant un élément de châssis (452-455), généralement rectangulaire, pour supporter une surface de tamisage perforée (451) ;
- ledit châssis extérieur (406) comprenant une

surface de collecte (467) pour recueillir la poudre criblée passant à travers ladite surface de tamisage (451) et décharger ladite poudre recueillie dans au moins un orifice (465) de chute de poudre fine, s'étendant généralement verticalement, et un moyen (461, 462, 468) définissant un orifice (469) de chute de poudre grossière, s'étendant généralement verticalement, dans lequel, à l'utilisation, la poudre non criblée est amenée à passer en quittant ladite surface de tamisage (451),

caractérisé par le fait que ledit châssis extérieur (406) comprend un moyen de paroi (461--463) définissant une cavité rectangulaire pour recevoir ledit châssis intérieur, et les surfaces supérieures dudit moyen de paroi (461--463), et la surface périphérique supérieure dudit élément de châssis rectangulaire intérieur (452-455) définissent ensemble un moyen de surface d'étanchéité (481), généralement coplanaire, rectangulaire, fermé, tourné vers le haut, et des régions de surface inférieure choisies dudit châssis extérieur (406) définissent un moyen de surface d'étanchéité (480), généralement coplanaire, rectangulaire, fermé, tourné vers le bas, correspondant, ce par quoi, lorsqu'il est empilé à l'utilisation avec un étage similaire avec les orifices de chute de poudre grossière disposés de façon alternée, le moyen de surface d'étanchéité (480) tourné vers le bas, se trouve en engagement d'étanchéité avec le moyen de surface d'étanchéité (481) tourné vers le haut, et en outre **par le fait que** ledit châssis intérieur (405) comprend un moyen de surface d'étanchéité (458a) rectangulaire, fermé, tourné vers le bas, qui entoure ledit orifice (459) de chute de poudre grossière et ledit châssis extérieur (406) comprend un moyen de surface d'étanchéité (468), rectangulaire, fermé, tourné vers le haut, pour coopérer en vue d'assurer l'étanchéité avec ledit moyen de surface d'étanchéité (458a) tourné vers le bas.

2. Châssis de cribleuse pour une cribleuse de particules de poudre, selon la revendication 1, dans lequel une feuille d'étanchéité par contact intime est appliquée sur au moins l'une desdites surfaces d'étanchéité (480, 481).

FIG. 1

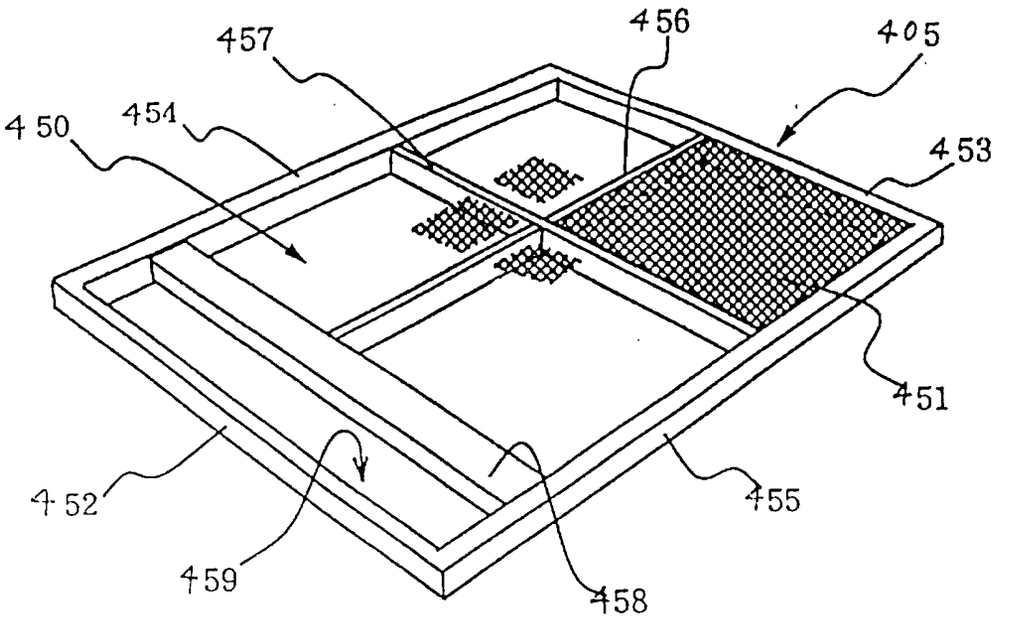

457
456
405
454
450
453
451
452
455
459
458

FIG. 2

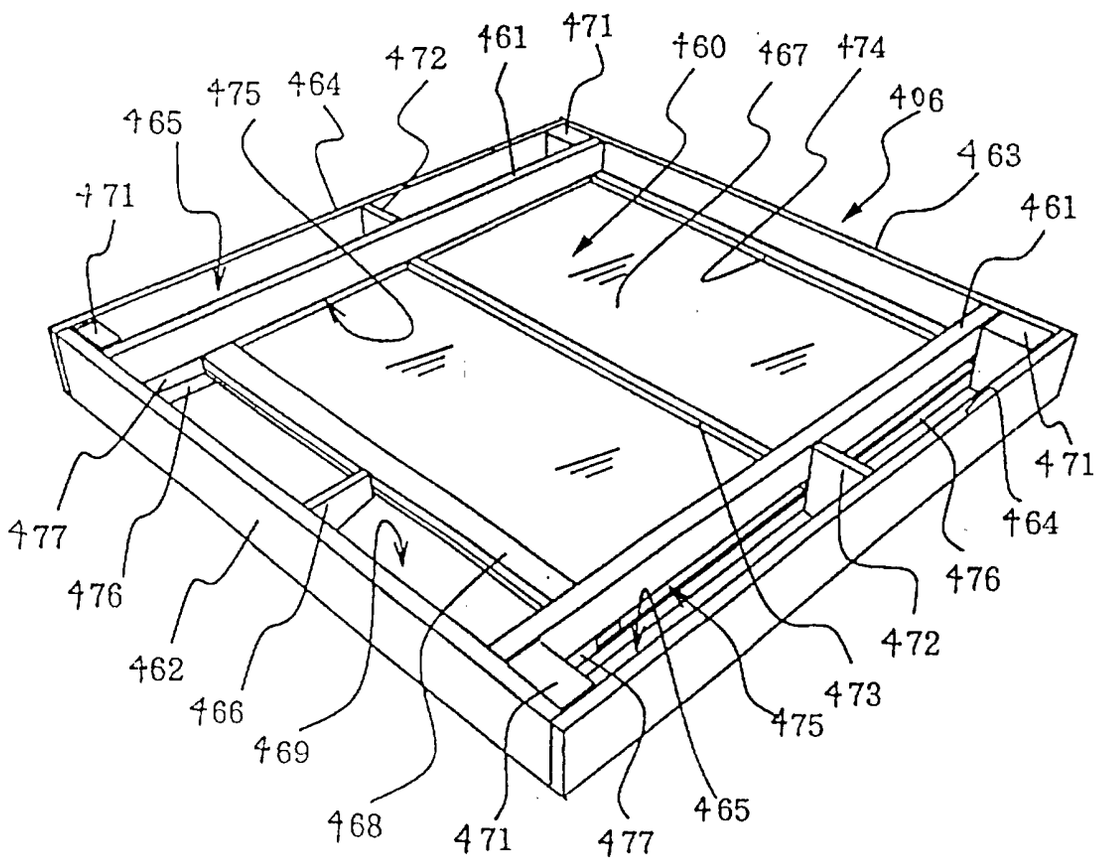
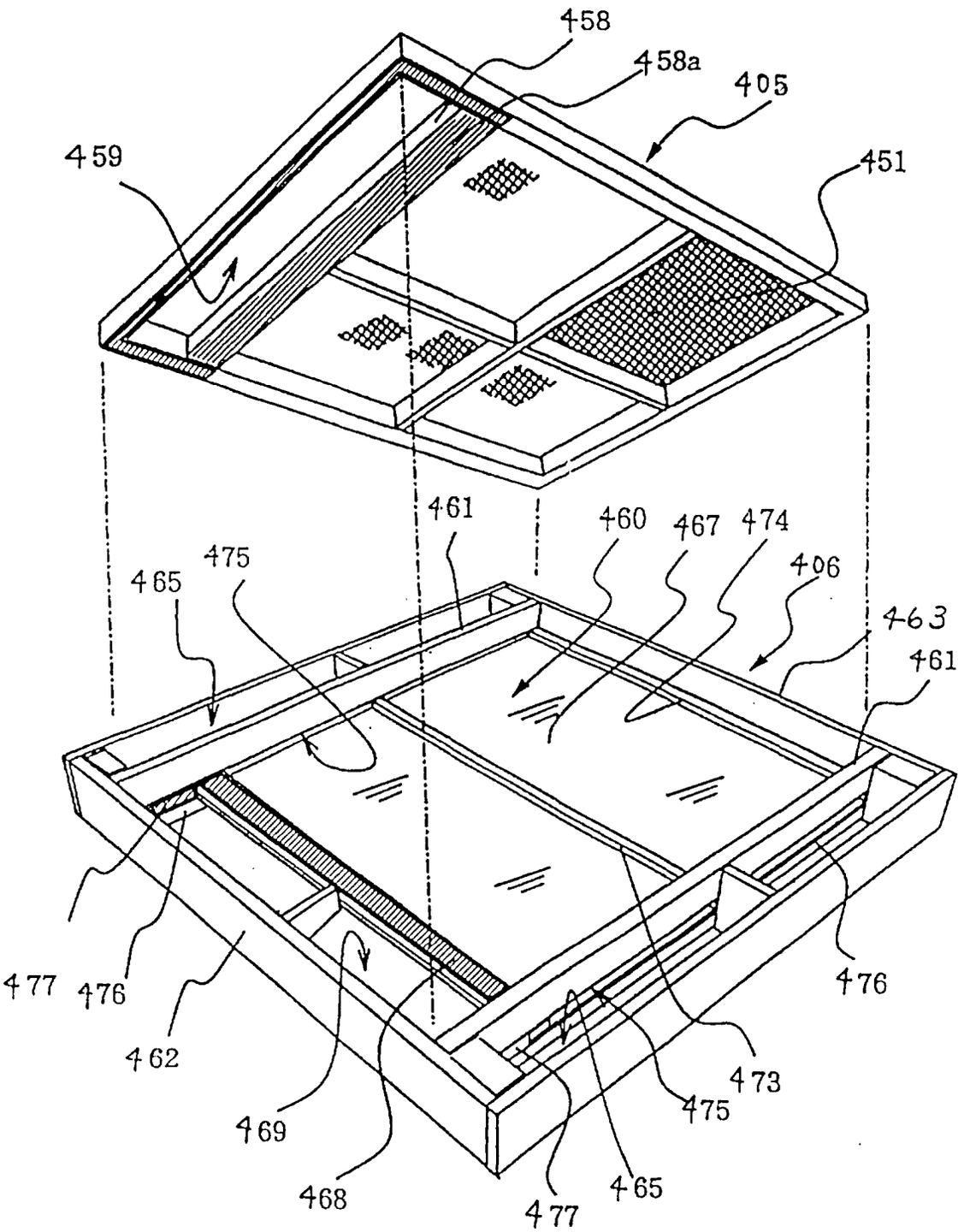

472
461
471
460
467
474
475
464
406
465
463
471
461
471
477
476
464
476
462
472
466
473
469
475
468
471
477
465

FIG. 3


458
458a
405
459
451
461
460
467
474
406
475
465
463
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476
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469
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473
476

FIG. 4

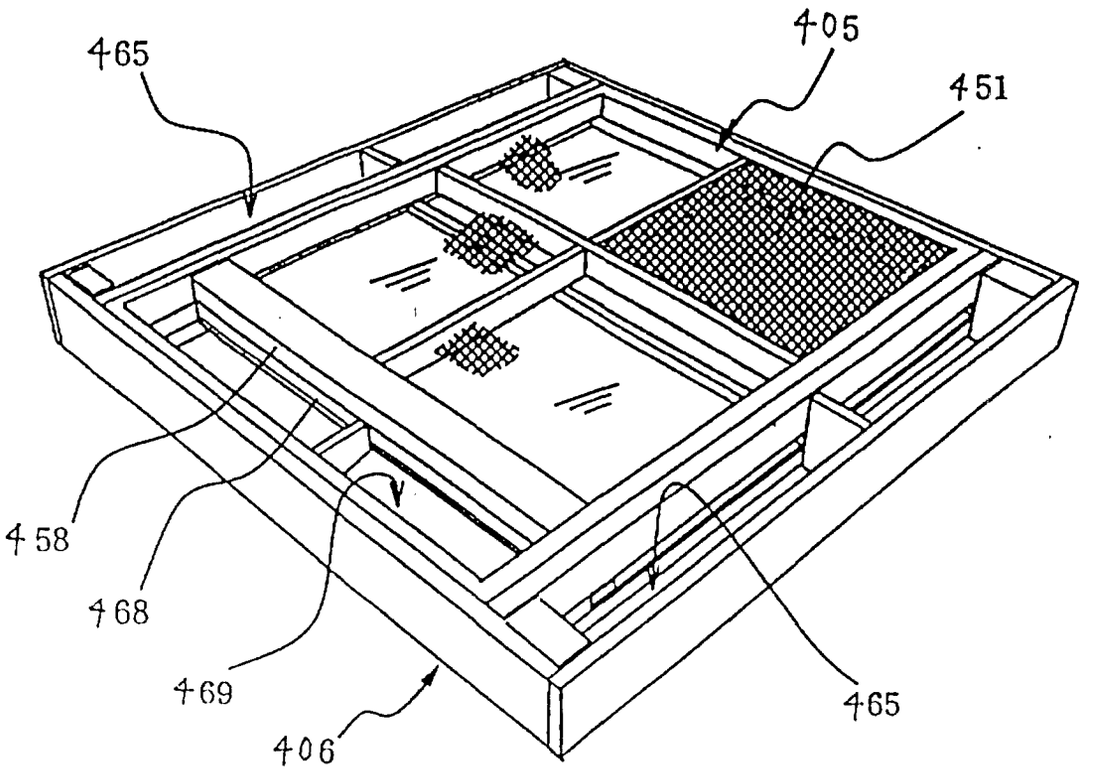


FIG. 5

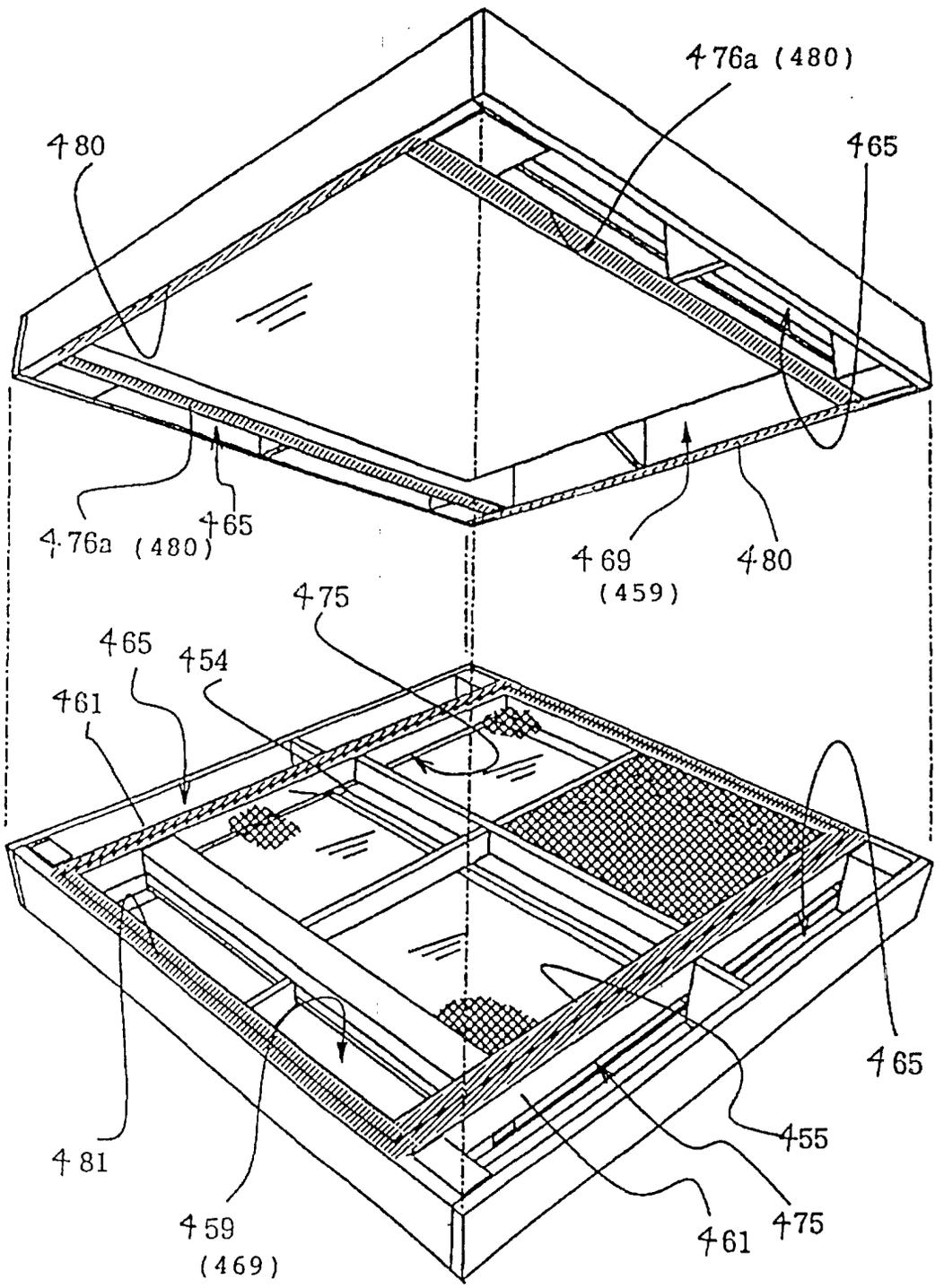

476a (480)
480
465
476a (480)
465
469 (459)
480
475
465
454
461
481
459 (469)
455
461
475
465

FIG. 6

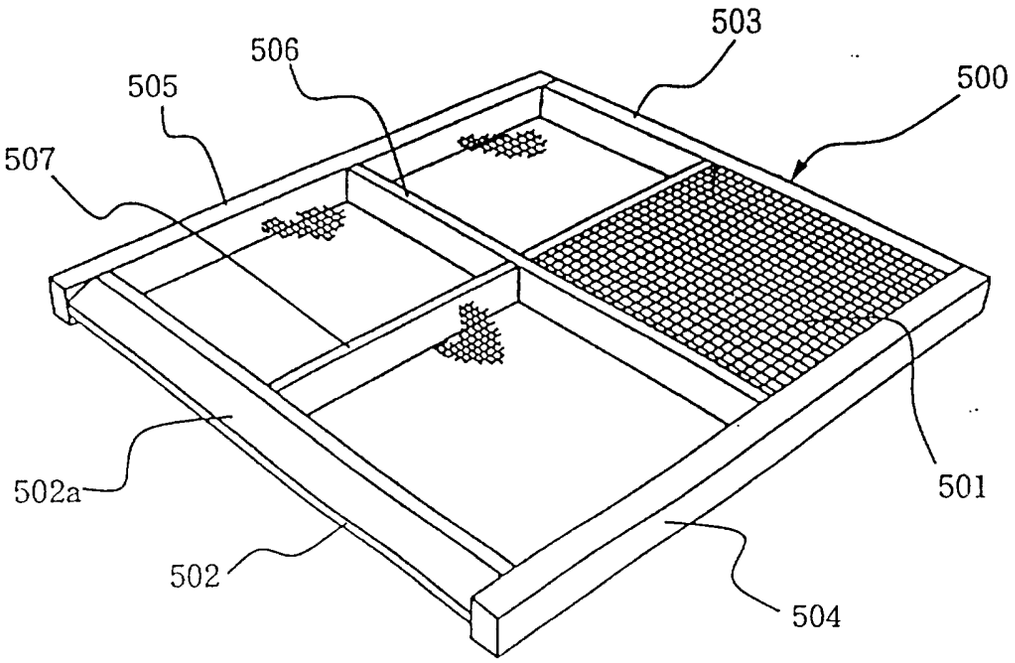
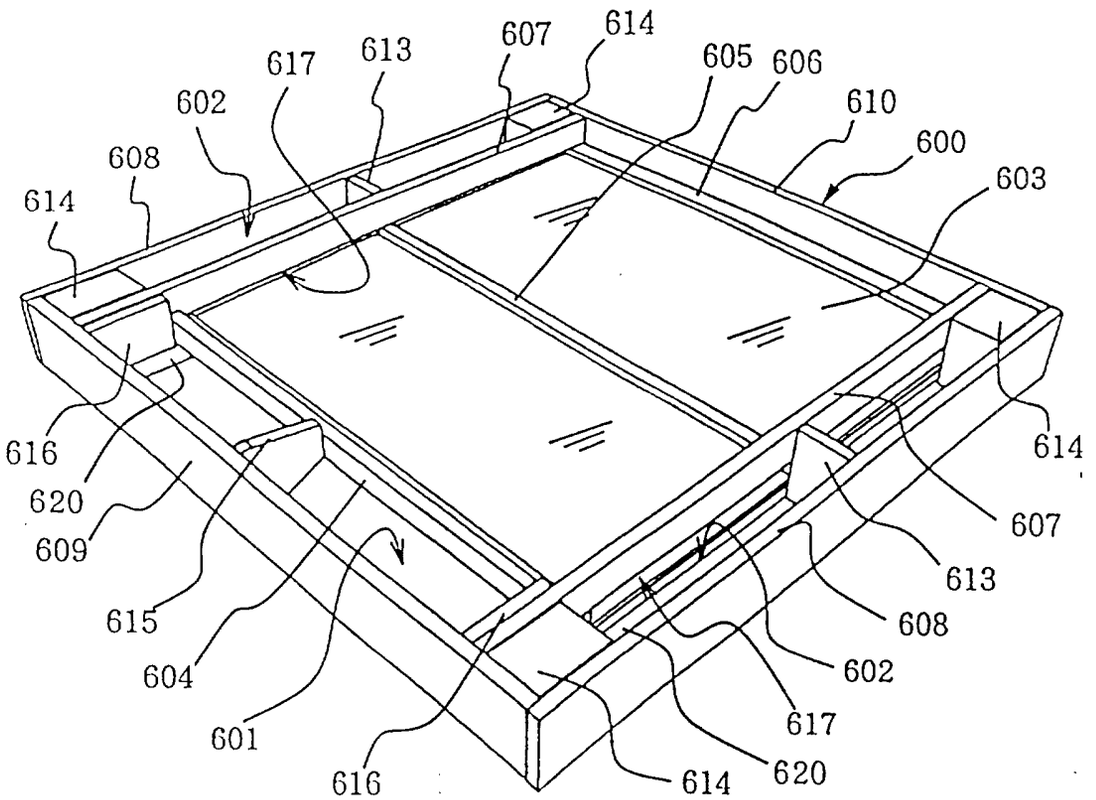

503
506
500
505
507
501
502a
502
504

FIG. 7


607
614
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602
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614
620

FIG. 8

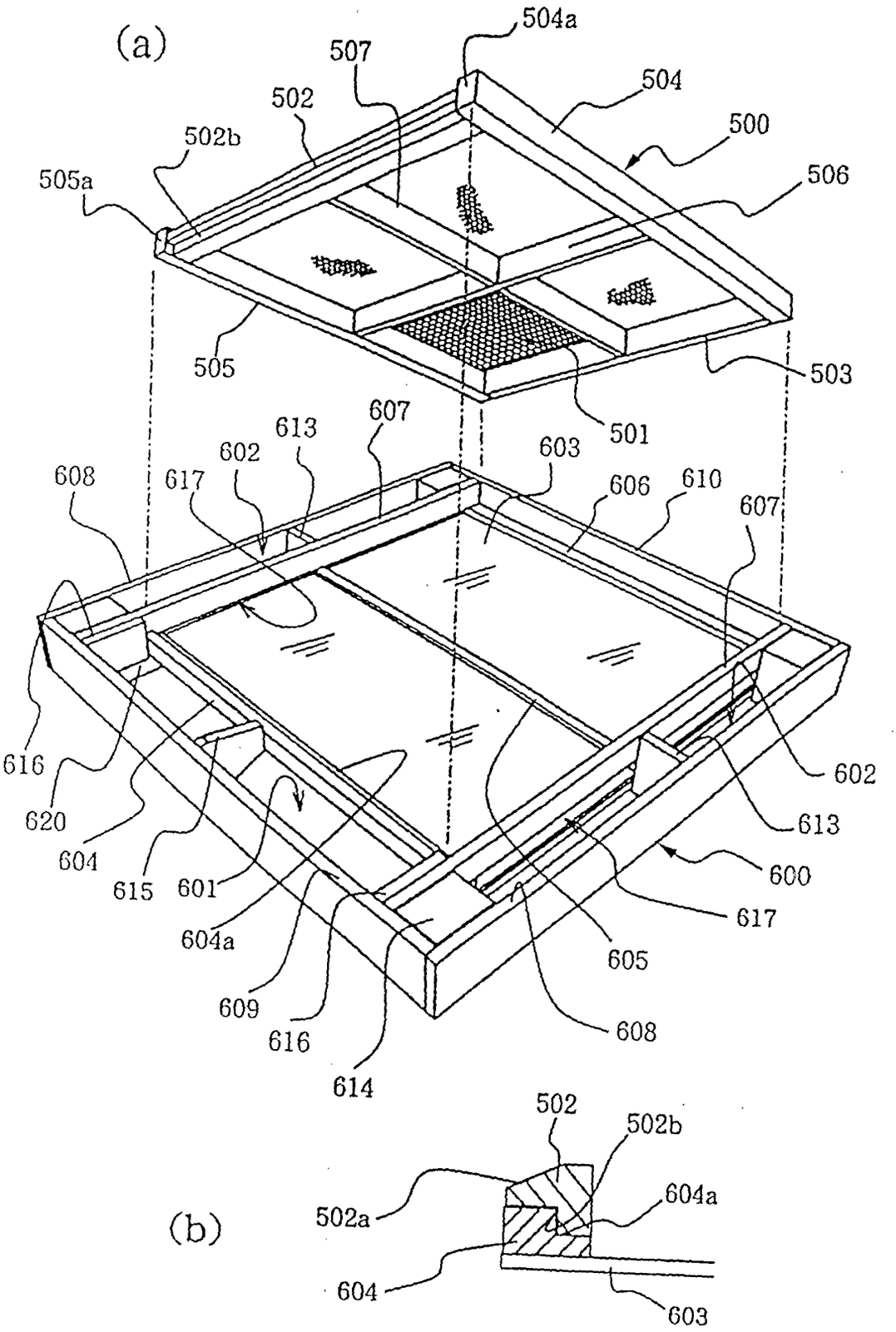
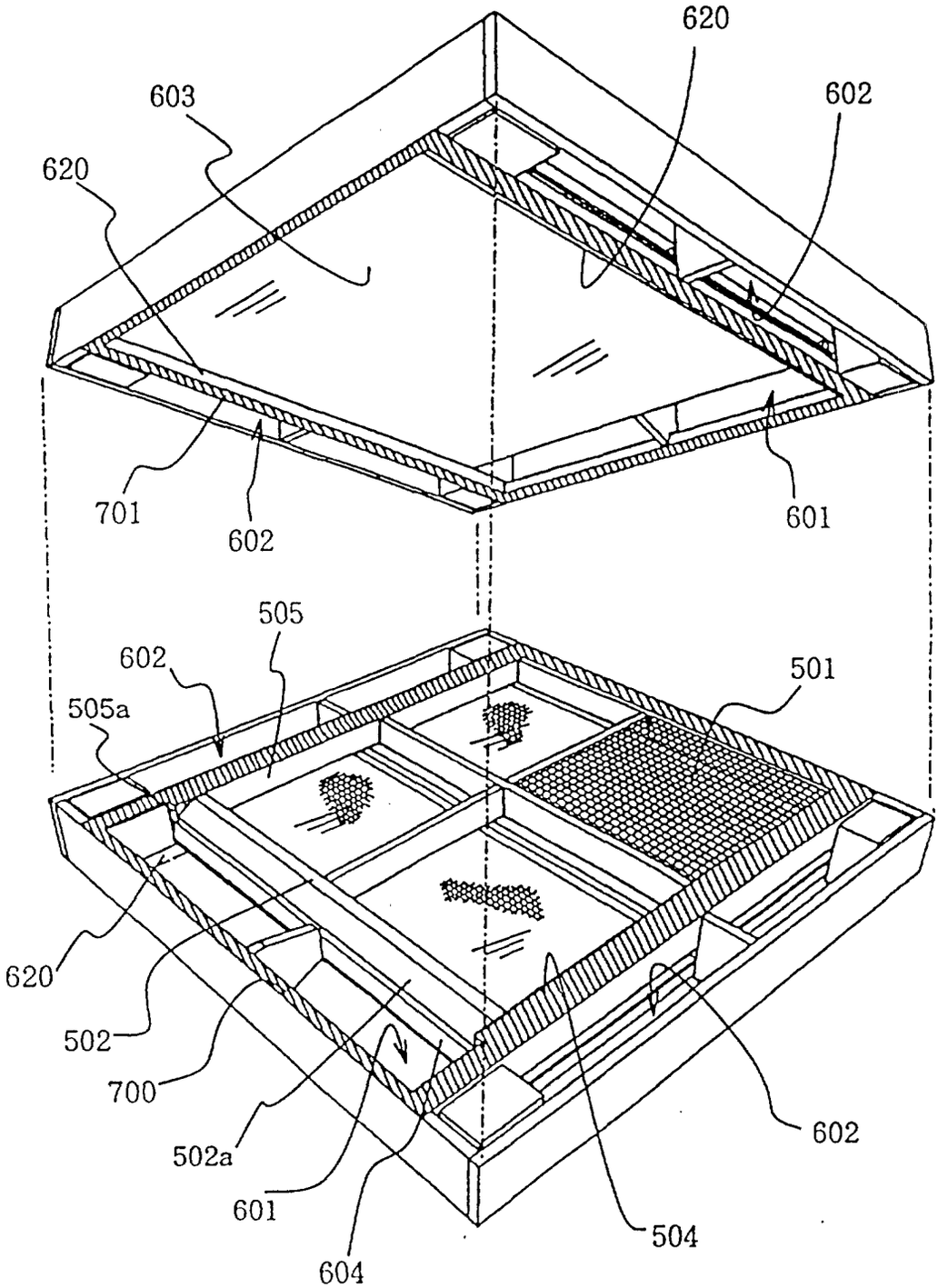

(a)
504a
507
504
502
500
502b
506
505a
505
503
501
607
613
602
603
608
617
606
610
607
616
602
620
613
604
600
615
601
617
604a
605
609
608
616
614
(b)
502
502b
502a
604a
604
603

FIG. 9


620
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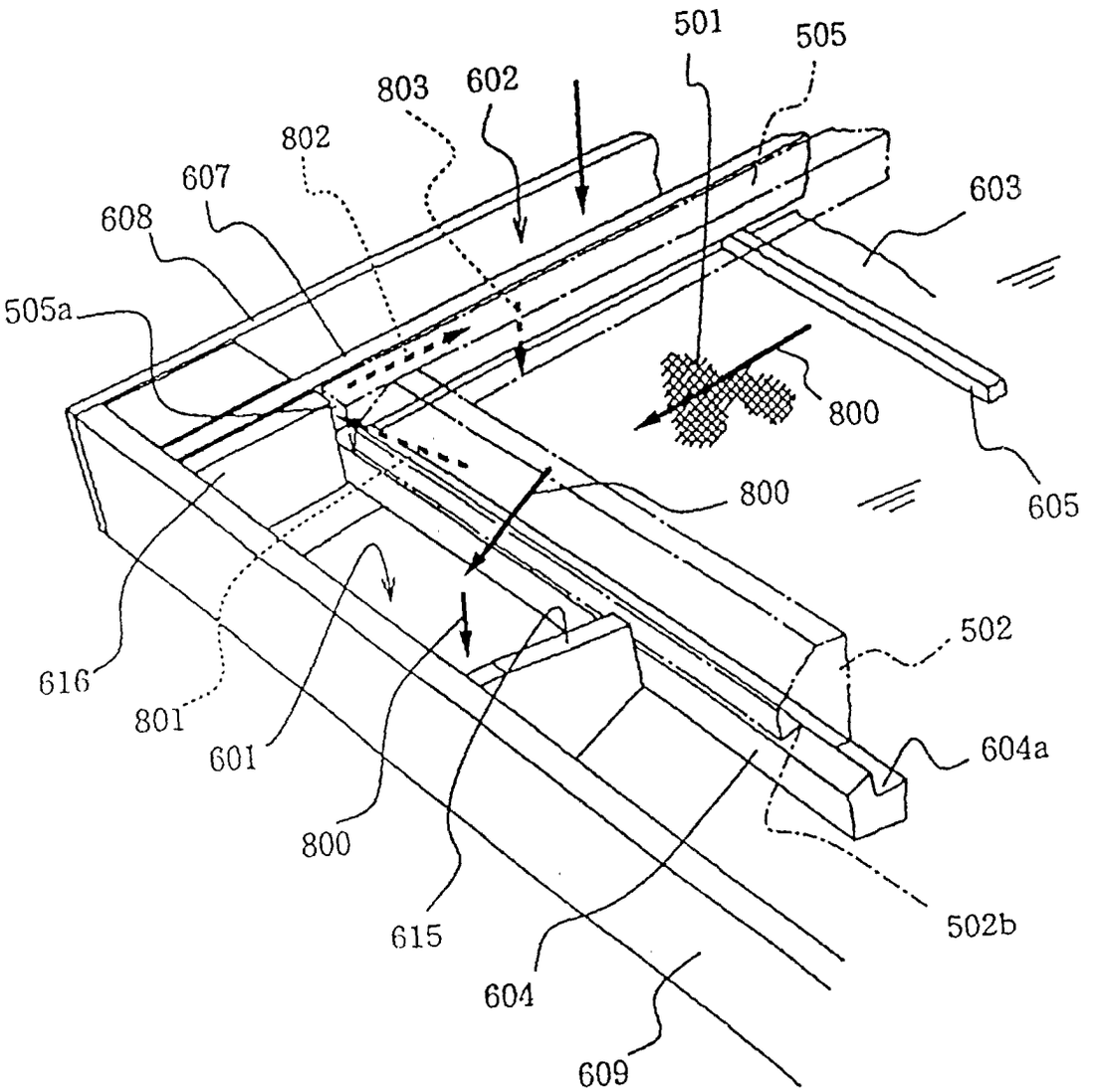
501
505a
620
502
700
502a
601
604
504
602

FIG. 10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801
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604a
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502b
604
609